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Cat Scratches Associated with Zoonosis as a Determinant of Public Health Risk

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Abstract **Review Article**

Several illnesses are known to be spread between people and pets. An emerging zoonotic infection called cat scratch disease (CSD) is transmitted by household cats. Pet kittens are the primary source of Bartonella henselae, and cats' bites or licking of wounds can spread the virus to humans. It can be found everywhere in the world and typically affects children and adolescents. In Pakistan, the first confirmed case of cat-scratch disease was recorded in Rawalpindi in 2018 and was documented in 2020. On May 29, 2022, a fresh case was discovered in Karachi. Both immune-competent and immuno-compromised people have contracted the illness. In temperate regions, higher rates have been seen in the fall and winter. The best methods used for identifying cat scratch infection are immunological and molecular methods. The condition frequently resolves on its own and does not require antibiotic therapy. Individuals who have compromised immune systems are more vulnerable to contracting the disease. Flea control inhibits the spread of cat scratch disease among cats, preventing it. Pet owners must wear protective clothes, and children and those with impaired immune systems must avoid contact with any suspected carrier cats.

Keywords: Pet Kittens, Cat Scratch Disease, Public Health, Zoonosis.

INTRODUCTION

People in various nations across the world keep a variety of animals as pets, including cats, dogs, rabbits, ferrets, hamsters, pigeons, parrots, canaries, and others (Mahendra Pal, Bulcha, Bune, & Lema, 2021).Since roughly 10,000 years ago, humans have shared their lives with cats and dogs. In our contemporary, urbanised society, they have been living beside us and have elevated to the position of "pets" (Khan *et al*., 2020; Sutu *et al*., 2020; Theel & Ross, 2019). Healthy cats and dogs have hundreds of different harmful bacteria in their mouths, including Bartonella species. A systemic illness known as cat scratch disease (CSD) is brought on by rod-shaped, non-motile, facultative intracellular bacillus known as Bartonella henselae (M Pal, 2007; Mahendra Pal *et al*., 2021). The sickness can affect a number of organs and cause a range of clinical symptoms .Worldwide, human illnesses brought on by Bartonella species are on the rise (Sutu *et al*., 2020). There are 25 different species of Bartonella, and it has been determined that roughly half of them may infect humans. An infectious ailment known as cat scratch disease or cat scratch fever is spread by direct contact with cats or kittens (M Pal, 2007). These bacteria are connected to a wide spectrum of diseases, including skin irritation, fever, lymphadenopathy, eye abnormalities, swelling in brain tissues, and inflammation in heart tissues (Mahendra Pal *et al*., 2021). The book "Zonoses" contains

additional details on zoonotic infections that can spread from companion animals including cats, dogs, rabbits, and ferrets to humans (M Pal, 2007).

Immunocompetent individuals who contract Bartonella henselae infection experience self-limited lymphadenopathy that lasts 2 to 8 weeks without the need for treatment. It is not required to make the diagnosis after coming into touch with an infected kitten, despite the importance of a exposure in the past. The manner in which this ailment presents will impact how it is treated(Del Pozo *et al*., 2019). The current statement highlights the cat scratch disease's growing significance as a new public health threat.

Globally Distribution and Occurence in Pakistan

Despite instances being documented everywhere, its international occurrence is unclear. It has been determined that this condition is associated with hot, humid areas (Waseem, Seher, Ghazal, Shah, & Habiba). According to a study by Nelson, Saha, and Mead (2016) that looked at the years 2005 through 2013, the incidence peaked in 2005 (5.7/100,000 people) and then gradually declined to 4.0/100,000 in 2013.

Only a few cases of cat-scratch sickness have been reported in Pakistan; the first confirmed case was identified in Rawalpindi in 2018 and was published in 2020(Jung *et al*., 2015). On May 29, 2022, a fresh case was found.

The seasonal nature of cat scratch illness, which is most prevalent in the cold weather , may be explained by trends in cat propagation or domestic ownership during these seasons .The world is home to B. henselae (Yehudina & Trypilka, 2021). It was confirmed that cats and human infection with B. henselae are related after the bacteriological cause of CSD was identified. More than 90% of patients had experienced cat encounter in the past. According to a case-control study, the factors that were most strongly linked to CSD occurrence included owning a cat (12 months or younger), having your face licked, scratched, or bit by a kitten, and having a kitten with fleas.

Transmission

Humans are scratched by cats whose claws have become contaminated with disease-carrying flea excrement as shown in, and these scratches are a major source of horizontal cat-to-cat transmission of the bacterium B. henselae, which also likely involves vertical transfer from infected queens to their young (Okaro, George, & Anderson, 2021). By a scratch contaminated with flea faeces, B. henselae enters the body most frequently. By bites or abrasions, which the cat licks, certain pathogens in cat saliva can be passed on to people (Mahendra Pal *et al*., 2021) as shown in Figure 1. It is still unknown if the bacterium found in cat saliva originated from the feline's blood or flea faeces ingested during brushing (Khan *et al.*, 2020).

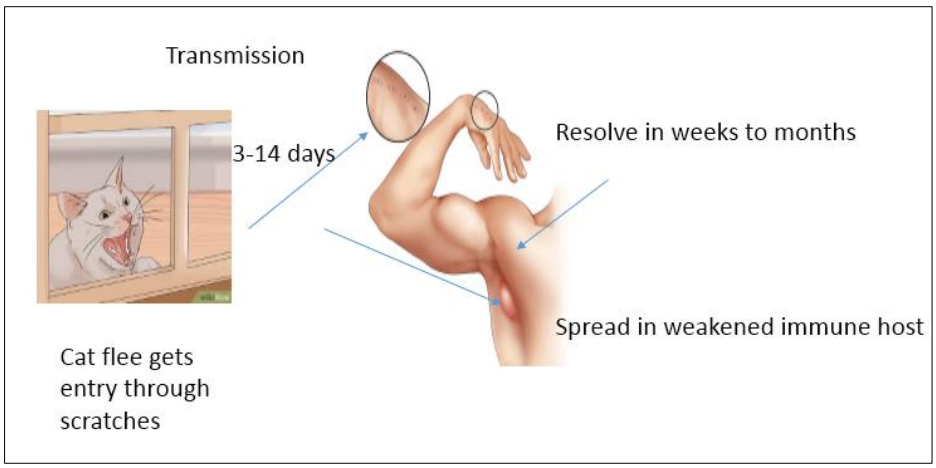

Figure 1: Transmission of bacteria through cat scratches

There is no proof that zoonotic Bartonella can spread via inadvertent contact between individuals (Menezes, Ribeiro, & Lima, 2020). Contrarily, Bartonella henselae was cultivated from human red blood cells infected with the bacteria and maintained at 40°C for 35 days, suggesting that it might be transmitted by blood transfusions (Konstantinou, Skrapari, Megkou, & Kokkinakis, 2020).

Pathogenesis

Cat scratch disease (CSD) is a feline infection that can spread to humans through scratching, biting, or infected injury, particularly in young cats (kittens) (5). CSD typically has a varied clinical course that starts at the inoculation site, progresses to several lymph nodes, and then manifests as generalised systemic symptoms. A thorough history is essential to a correct diagnosis since it starts as a single or several red papules 3–4 days after inoculation at the site of infection. The papule goes through several stages, from erythematous to vesicular to papular to crusty. Regional

lymphadenopathy often occurs 1-3 weeks after the initial factor and frequently affects just one node, recurring after a few months. Asymmetrical involvement of the head, neck, and groyne lymph nodes, as well as the axillary and epitrochlear nodes, is also possible. When seen under a microscope, the nodes are found to be numerous, highly vascularized, and hyperechoic.

Clinical Manifestation

The importance of this bacterial infections in animals is unclear as they first showed no symptoms. Investigations are complicated by the great prevalence of infections in healthy animals, the ambiguity of laboratory tests for these species, and the potential of co-infection with other bacteria (Sutu *et al*., 2020).

In Cats

Cats with B. henselae bacteremia who are naturally infected typically show no symptoms. In experimental studies, the majority of cats given this organism by injection either showing no symptoms or only displayed slight clinical symptoms, such as inoculation site reactions, minor nonspecific febrile illness, transitory slight behavioral symptoms, minor transitory anaemia, eosinophilia, or reproductive abnormalities. One flea-infected cat was exceedingly unwell, and a necropsy revealed myocarditis. This cat may not have developed an efficient immunological response to the infection, according to International Journal of Research in Medical and Clinical Sciences 3 Journals Era Publications. In a similar vein, it has proven challenging to establish that Bartonella in naturally infected cats results in sickness (Johnson, Kosut, & Ching, 2020).

In people

Some persons can contract Bartonella henselae, which can then spread to their liver, spleen, eyes, or central nervous system. Individuals with a localised illness typically have a self-limiting condition, however those with a widespread illness may confront potentially fatal effects. The most common clinical sign of CSD is chronic lymphadenopathy (Keret, Giladi, Kletter, & Wientroub, 1998). Common symptoms include warm, painful, and erythematous nodes. The most frequent but minor symptoms include fever and systemic ones including lethargy, malaise, anorexia, and headache. A single node was affected in the majority of patients (about 50–85%), with the axillary and epitrochlear, head and neck, and inguinal nodes being the most common (Theel & Ross, 2019) .Figure 2 depicts a slice of a immune system tissue with areas of a sphacelus as well as capsular and subscapular granulomas, all encircled by palisading histiocytes.

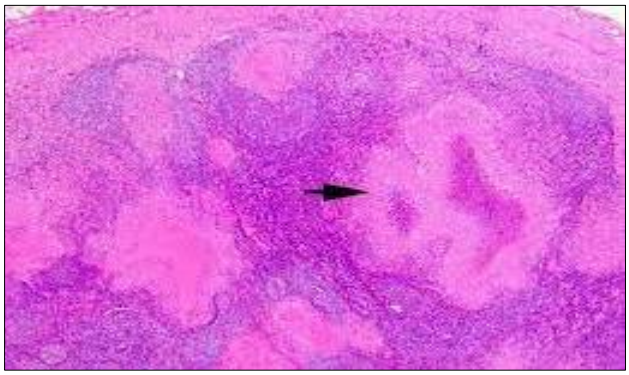

Figure 2: A lymphoid tissue with areas of a sphacelus as well as capsular and subcapsular granulomas, may be seen in the section under examination.

Immune-Competent Individuals

The B.henselae-caused benign regional lymphadenopathy that characterises cat scratch disease. Seven to twelve days after getting scratched (or bitten) by a cat, a papule and then a pustule appear at the injection site *(Rozmanic et al*., 2007). According to (Rajapakse, Rodrigo, Balaji, & Fernando, 2015), regional lymphadenopathy can start one to three weeks after the initial vaccination and extend for several weeks to several months.

In most cases, people with cat scratch illness encephalopathy fully recover without any issues within a year. Recent research has revealed that B. henselae is frequently to blame for prolonged fevers and fevers of unclear aetiology in infants (FUO). Children's rheumatic symptoms and bartonella infection have both been connected(Okaro *et al*., 2021)

In People with Weak Immune Systems

A common clinical sign of Bartonella infections is bacillary angiomatosis (Keret *et al*., 1998).Affected individuals display chronic vascular proliferative lesions that, both clinically and histologically, are identical to those caused by B. bacilliformis. Lesions caused by bacillary angiomatosis are more likely to develop in HIV patients with a helper T cell count of less than 50/mm3. Skinny bacillary angiomatosis exhibits proliferating capillaries and protruding epithelioid endothelial cells on histological

analysis, which gives it a tumor-like growth pattern (Menezes *et al*., 2020)

Diagnosis

A thorough physical examination, which includes looking for possible inoculation sites on the hands, arms, face, ribcage, and scalp, is crucial for the diagnosis of CSD. The history of the patient should be carefully taken into account, paying special attention to any contact the patient has had with cats and any injuries that may have resulted from this contact (Johnson *et al*., 2020).Historically, the diagnosis of CSD required three out of four of the following criteria: (1) contact with a infected kitten and a primary inoculation site; (2) a positive CSD skin test result; (3) negative research findings for other causes of moderate swelling of immune tissues; and (4) distinctive tissue changes at microscopic level visible on the biopsy (Bejarano, Del Moral, & Guisado-Gil, 2020).

However, worries about the safety of the skin test and the development of superior molecular diagnostic technology have partially changed this. Bartonella sp. requires an incubation time of 2 to 6 weeks for primary isolation, making it challenging to isolate in culture. Moreover, isolating B. henselae is typically ineffective in people who do not have a systemic disease. The most popular diagnostic test for B. henselae is blood serum (Annoura, Sano, Makino, & Kawashima, 2020).

Serology

Since serology for B. henselae antibodies does not require intrusive sample collection, specialised tools or techniques, or prolonged incubation times, it is a more practical method of laboratory diagnosis. Immunofluorescent antibodies, ELISAs, and immunoblotting are examples of serological assays for B. henselae (Bejarano *et al*., 2020; M Pal, 2007).

Although many asymptomatic cats have positive serology due to prior (often quiet) exposure, serologic assays, while more sensitive than culture, lack specificity. Because all serological tests have a high probability of false-positive test results, the authors recommend combining serology with blood culture or PCR testing. Some infected cats and dogs may show negative resultss to Bartonella, despite the fact that the organism can be identified in blood and/or tissues by culture or PCR (Lin, Nguyen, Qian, Phan, & Nguyen, 2020).

Cultivation of Bacteria

To establish the diagnosis of Bartonella infection, the organism should be cultured from blood or tissues, such as lymph nodes or heart valves (endocarditis), or Bartonella-specific DNA sequences from tissues should be amplified using PCR (Lemos, Domingues, Gouveia, de Sousa, & Brito, 2021). They might be simpler to culture from some hosts than others (like B. henselae in kittens) (Sarno *et al*., 2021). Many tries may be necessary, even in cats, required to identify bacteria in the blood since bacteremia might come and go. Fastidious Bartonella species require specialised media for isolation, including fresh chocolate agar or brain heart infusion agar that has been enhanced with blood. Typically, B. henselae colonies become visible in 9 days to 6-8 weeks (Naureckas and Sharma, 2020)

Polymerease Chain Reaction

Rapid identification and high specificity are two benefits of polymerase chain reaction (PCR). More recently, Bartonella has been found using cutting-edge diagnostic methods including PCR and serology. The three main methods for using PCR to determine Bartonella infection are amplification of the 16S rRNA gene, amplification of the citrate synthase gene (gltA), and amplification of the B. henselae htrA gene. Although PCR's sensitivity ranged from 43% to 76%, its specificity was excellent (Del Pozo *et al*., 2019).

Treatment

Until recently, antibiotics were rarely prescribed unless a secondary infection developed because it had not been demonstrated that they may alter the course of a typical sickness in immunocompetent patients.The use of intravenous trimethoprim-sulfamethoxazole, tobramycin, and erythromycin helped a patient who developed CSD septic shock following renal transplantation recover quickly. Systemic antibiotics are highly helpful in treating immunocompromised people (Annoura *et al*., 2020). Treatment is directed towards ease for every sign of CSD. It is necessary to repeat the process of aspirating suppurated nodes, applying local heat to affected nodes, using analgesics, and avoiding harming lymph nodes (Lin *et al*., 2020).

Control and Managmental Approach

Although officials do not advise doing away with cats from the home, their capacity to transmit B. henselae is sporadic. According to Konstantinou *et al*., (2020) it is unclear whether antibiotics can successfully eradicate B. henselae bacteremia. According to the 2009 Guidelines for Avoiding Opportunistic Infections Among HIV-Infected Adults and Adolescents, there is no proof that routine culture can prevent opportunistic infections. The flea treatment reduces the possibility that indoor cats will contract B. henselae or spread it to other cats. According toSutu *et al*., (2020), the majority of patients' diseases resolve on their own over the course of many months.

By eradicating cat fleas from cats and avoiding extreme cat contact, which is especially important for people with compromised immune systems, cat scratch illness can be averted (Flyger, Larsen, & Kjeldsen, 2020). The cat should come from a home without fleas and ideally be an adult cat. Cats might be serologically

tested therefore prospective owners could only adopt a sero-negative cat. There have also been suggestions to declaw the cats (Allizond *et al*., 2019). The best strategy to prevent B. henselae infection is to employ common sense, which includes keeping cats clean and even changing cat owners' behaviour. People should immediately cleanse their hands after dealing with pets and treat wounds, bites, or scratches with soap and water (Bejarano *et al*., 2020). The most important thing is to always take action to control fleas (Nelson *et al*., 2016).To reduce cat-related scratches and bites, people should refrain from rough play with cats and kittens (M Pal, 2007).

CONCLUSION

The clinical picture of CSD mimics a number of chronic conditions, including cancer and tuberculosis, thus it is critical that a correct diagnosis be made in light of the fact that this is the second case of the disease to be reported in the nation. It is crucial to get a correct diagnosis because tuberculosis is common in Pakistan and shares striking parallels with the clinical manifestation of CSD. Cat-scratch illness should be considered as a potential factor in the discrepancy studies of a patient who presents with lymphadenopathy, especially in young patients. Clinicians hardly ever think of CSD as a potential cause of a patient's clinical signs in Pakistan because of its low prevalence. Nevertheless, the current documentation of two cases in two different provinces (Punjab and Sindh) and age ranges (8 and 23 years) emphasises the significance of being aware of the ailment's potential whenever a patient exhibits signs like swelling of lymphoid tissue, undifferentiated swelling in joints, and a temperature without an apparent cause. To avoid iatrogenic impairment in the quality of life of the afflicted, a perfect past cases and examination must be performed, and applicable skills must be used for the correct diagnosis and treat the patient accordingly.

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